Single Schedule Market Pricing Issues

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Phase 1 - Session 2
Module B: Reserve Pricing

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MODULE B: RESERVE PRICING

INTRODUCTION Operating Reserves

With the implementation of the SSM, the IESO will continue to schedule operating reserves concurrently with dispatching energy.

- Operating reserves ensure that the electricity system can operate reliably in the event of a contingency, such as an unplanned transmission or supplier outage.
- Resources scheduled to provide operating reserves can be called on to provide that reserve energy to the grid within a specified time frame, by either increasing output or reducing load.

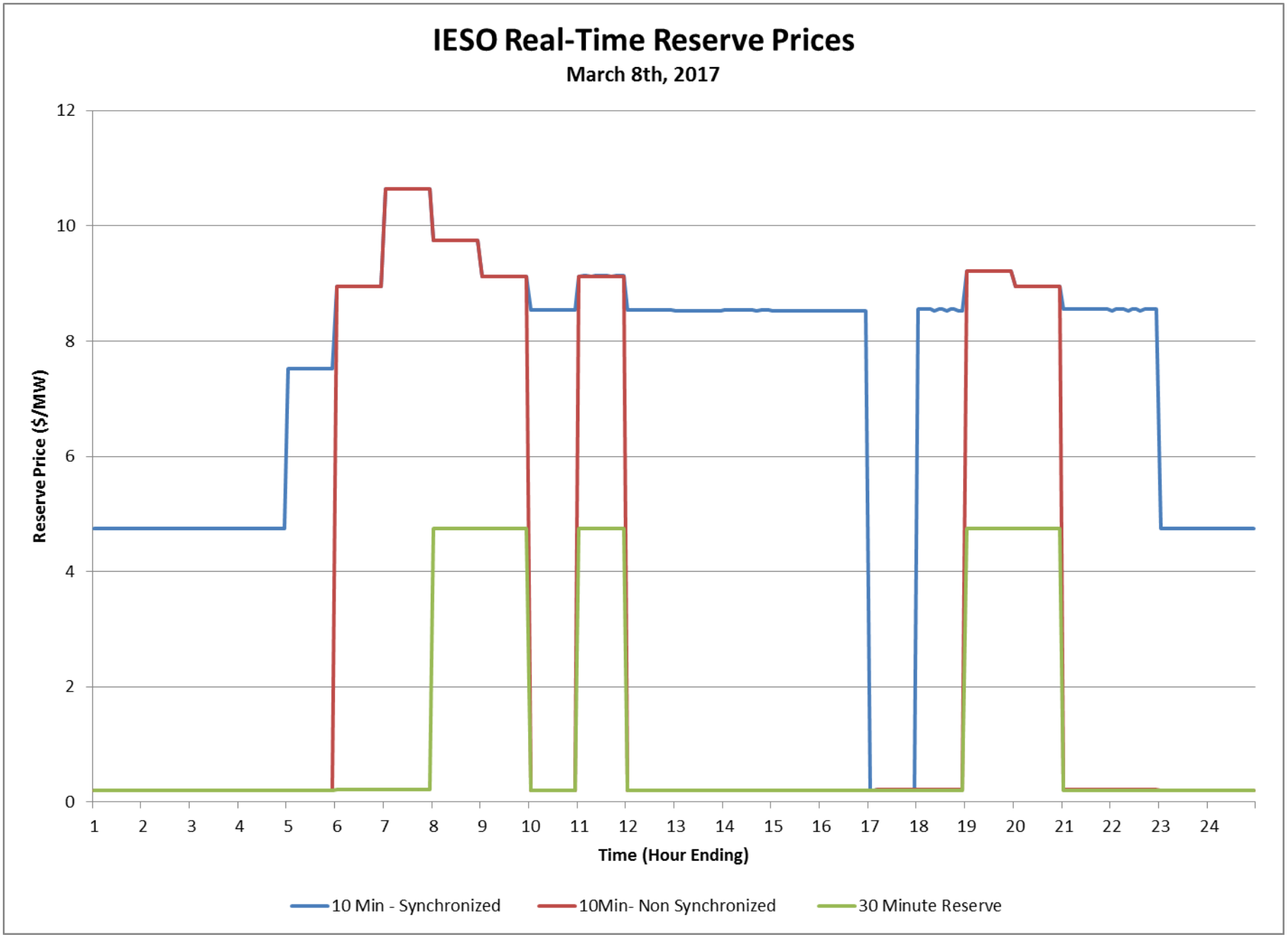
The IESO maintains three types of operating reserves in its dispatch:

- 10 minute spinning reserves (10S)
  - Can respond in less than 10 minutes.
  - "Spinning" means the reserves must be provided by units that are already on-line and generating or synchronized to the transmission system.
- 10 minute non-spinning reserves (10N)
  - Can respond in less than 10 minutes.
  - Can be provided by off-line units.
- 30 minute reserves (30R)
  - Can respond in less than 30 minutes.

INTRODUCTION Operating Reserve Requirements

In dispatching the system, the IESO attempts to meet reliability requirements for the minimum/maximum level of each type of operating reserve:

- For the system as a whole (minimum level only).
- Within specific local regions:
  - Transmission congestion may constrain the amount of energy that can be imported into specific regions in contingencies.
  - This leads to reserve scheduling restrictions which model limits on the ability to deliver power from activated operating reserve in/out of physical sub-areas within Ontario.
  - Local reserve areas may be nested, with differing requirements at each level.


IESO Real-Time Reserve Prices
March 8th, 2017
Reserve Price ($/MW)
0
2
4
6
8
10
12
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
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19
20
21
22
23
24
Time (Hour Ending)
10 Min - Synchronized
10Min- Non Synchronized
30 Minute Reserve

INTRODUCTION Operating Reserve Scheduling

The IESO schedules operating reserves today in the constrained schedule concurrently with its real-time energy dispatch (called "co-optimization").

- Qualified generation suppliers, imports and dispatchable loads voluntarily offer/bid to provide energy and one or more types of reserves.
- The IESO determines the least-cost constrained schedule, evaluating the bids and offers and scheduling energy and reserves at the same time.
- A MW of capacity can be scheduled in the dispatch to provide only one product, i.e., energy, 10S, 10N, or 30 minute reserves.
- This co-optimization of energy and reserves in the constrained schedule is the best practice in LMP markets.

INTRODUCTION Operating Reserve Pricing

Like energy, operating reserves are currently scheduled in the constrained schedule but are priced in in the unconstrained schedule.

- The scope of SSM includes changes to operating reserve pricing and the elimination of the unconstrained schedule.
- These changes will provide market pricing incentives and signals for the supply of reserves that are aligned with physical dispatch of reserves at each location.

Under SSM, pricing rules for operating reserves in the IESO could change, but:

- The global or regional reserve requirements would presumably not change.
- The methodology for co-optimizing the schedules for energy and reserves based on bids and offers need not change.

Possible improvements to the specification of operating reserve requirements and the impacts on pricing will be discussed in Module C: Pricing Constraint Violations.

OTHER ISOs Operating Reserve Scheduling and Pricing

A number of ISOs operating SSM markets co-optimize their energy and reserve scheduling in the real-time dispatch.

- Scheduling of resources for each type of reserve is determined by reserve offer prices, if applicable, and opportunity costs in the energy market.
- Reserve prices are set by the incremental cost of reserves, including reserve offer prices and opportunity costs in the energy market or reserve shortage prices if reserve targets are violated.
- The New York ISO and ISO New England calculate real-time reserve prices based solely on the opportunity costs of energy and reserve shortage prices.
- The MISO and SPP use participants' offer prices for reserves in their reserve price determination.

OTHER ISOs Operating Reserve Scheduling and Pricing

Not all SSM-type LMP markets co-optimize energy and reserve markets in the real-time dispatch.

- The California ISO currently co-optimizes reserves and energy in its 15-minute market but not in the real-time dispatch. It has announced its intent to move to a full real-time co-optimization of reserves and energy.
- ERCOT does not co-optimize or re-optimize energy and reserve schedules during the operating day. This design is likely to be replaced by a co-optimized design in the next few years.
- PJM does not clear a market in primary reserves (spinning reserves).

RESERVE PRICING

A typical SSM design for reserve pricing such as those in operation in the NYISO, MISO, SPP and ISO New England is very similar to energy pricing. Reserve prices:

- May vary by location.
- Are calculated from the constrained schedule, rather than from an unconstrained schedule.
- Consist of a system-wide price, plus a congestion component.
- Reflect the difference in the marginal cost of scheduling an increment of reserves in different locations when transmission limits constrain where reserves are scheduled.

RESERVE PRICING — Status Quo: Unconstrained

In Ontario today, reserve prices are co-determined with energy prices in the unconstrained schedule based on offers/bids for reserves and energy.

- The unconstrained schedule ignores minimum and maximum limits associated with local areas.
- Reserve prices today:
  - Are the unconstrained clearing price for each class of reserves.
  - Are uniform across locations within Ontario.
  - Include opportunity costs but do not include a congestion component when there is an increased cost of supplying an increment of reserves at a location due to transmission congestion.

RESERVE PRICING — Status Quo: Unconstrained

The uniform reserve prices today do not reflect differences in the incremental value of reserves in different locations.

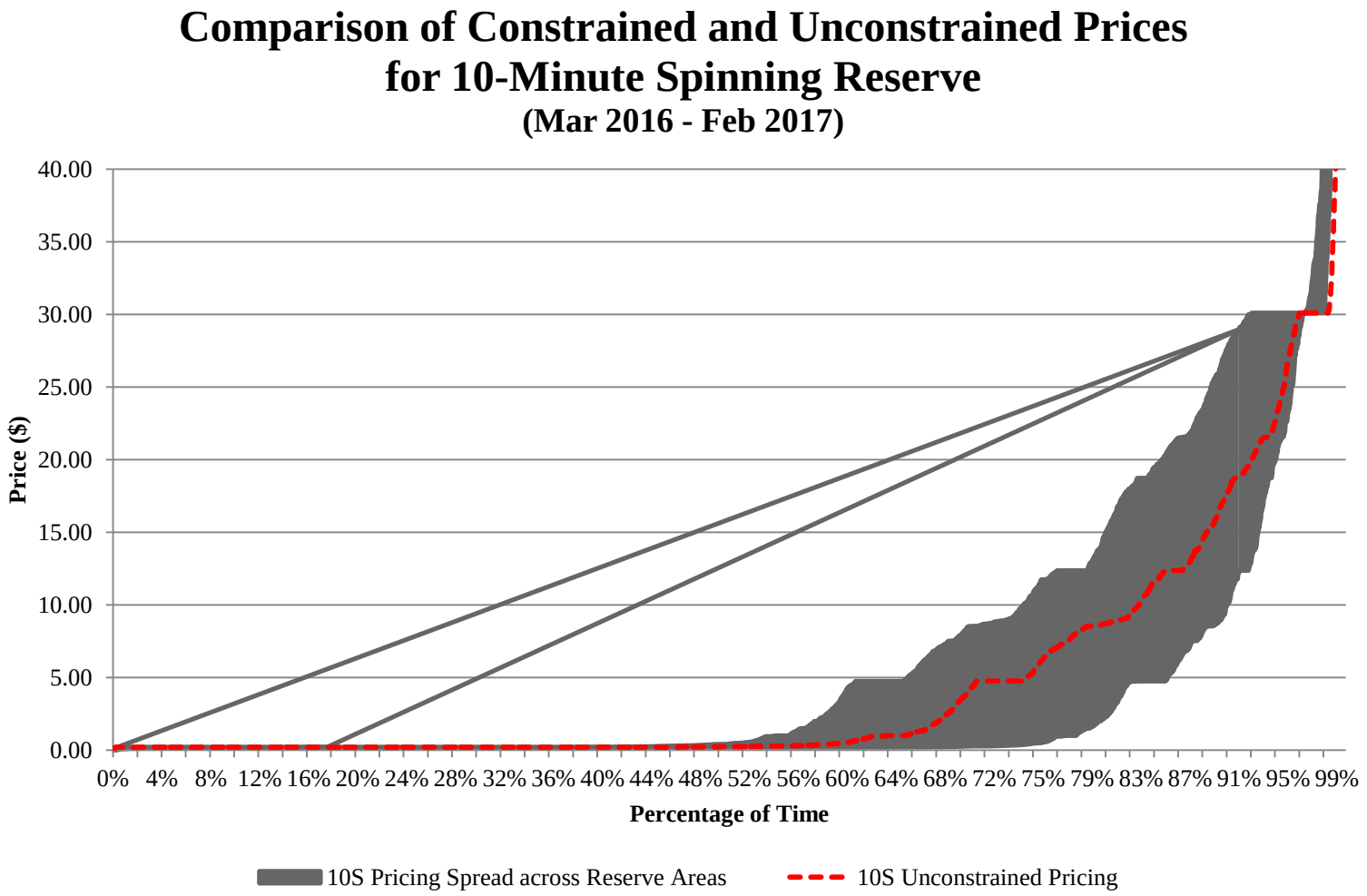
- The prices therefore are not typically consistent with the offers, bids and dispatch of generation and load resources.
- CMSC payments are needed to align short-term incentives with IESO operating reserve dispatch instructions.

RESERVE PRICING — SSM: Constrained

Under a typical SSM design, reserve prices are calculated in the same constrained dispatch in which energy prices are determined for settlement.

- The reserve price at a location will correspond to the marginal offer/cost of scheduling an incremental MW of reserves at that location in the dispatch.
- There may be different prices for the same reserve type across the province as a result of transmission limitations that prevent the delivery of activated operating reserve.
- While reserve prices are currently calculated in the constrained schedule, these may not be settlement-ready.

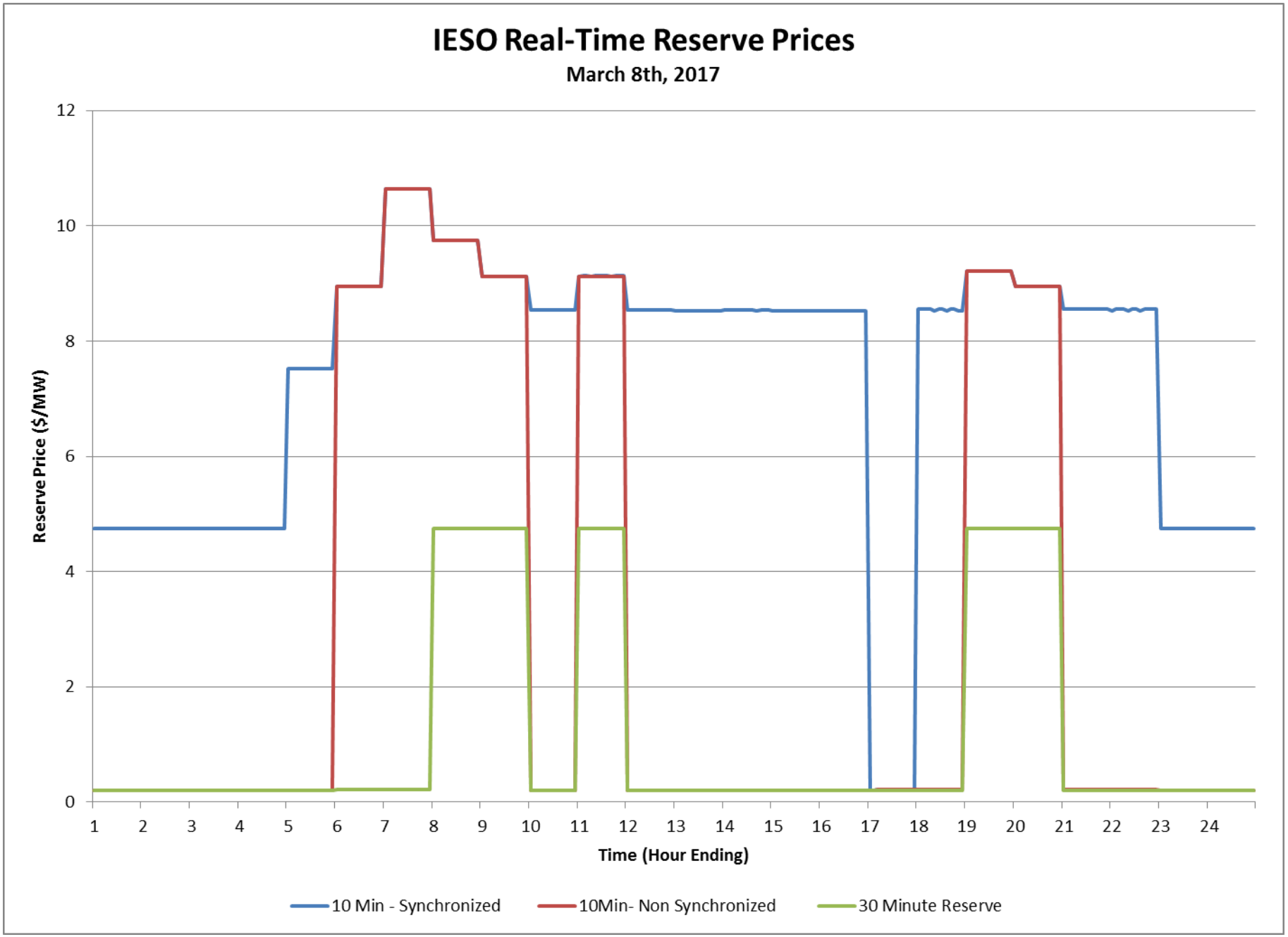
EXAMPLE 10S Locational Differences



RESERVE PRICING SSM: Constrained and Co-Optimized

In a constrained dispatch that co-optimizes schedules for energy and reserves, tradeoffs between utilizing the offers a supplier submits for energy versus reserves are reflected in clearing prices.

- As a consequence, the prices for energy and each type of reserves are related.
  - Schedules will be consistent with the clearing prices for energy and reserves.
  - Market prices will reflect opportunity costs when a resource is scheduled to provide a lower-valued product (such as 10S) rather than a higher-value product (such as energy); this results in "cascading" of the relative prices.
- Reserve prices will change under SSM (versus the status quo) because of the impact of both transmission constraints and reserve requirements on energy and reserve schedules.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RESERVE PRICING — SSM Settlement

In an LMP market the operating reserve price at each location (for each type of reserves) is the sum of the system-wide reserve shadow (reference) price and the operating reserve congestion cost for the location.

- Suppliers of 10S are paid the 10S clearing price for the quantity of 10S they are scheduled to supply.
- Suppliers of 10N are paid the 10N clearing price for the quantity of 10N they are scheduled to supply.
- Suppliers of 30 minute reserves are paid the 30 minute reserve clearing price for the quantity of 30 minute reserves they are scheduled to supply.

The cost of scheduling reserves based on these clearing prices will continue to be recovered from Ontario loads and exports through an uplift cost allocation.

RESERVE PRICING Other Possible SSM Changes

Reserve pricing could change from the status quo if:

- There were a change in the penalty price for operating reserves.
  - Alternatively, scarcity pricing could be implemented through the introduction of operating reserve demand curves.
  - These topics will be discussed in the Module C: Pricing Constraint Violations.
- If, in the introduction of SSM, there were concurrent changes in the physical dispatch or pricing run of the constrained schedule, such as changes to the current multi-interval optimization, ramp rate modeling, etc. This will be discussed in Module D: Multi-Interval Optimization and Pricing.